Initial	Date
CW	3-1-01

BA WTR
BA SD
Mail Stop 60189

MAR 0 1 2001

To: Refuge Manager, Lake Andes National Wildlife Refuge

From: Chief, Division of Water Resources /S/ CHERYL C. WILLISS

Subject: 2000-2001 Water Use Report/Water Management Plan

The subject report for Lake Andes National Wildlife Refuge has been reviewed and approved as submitted.

Thank you for the timely submission of this report.

Attachment

bcc: WTR rf
RO rf
Refuges Supervisor, Shupe
WTR:LCOE:02/28/01
I:\WATERUSE\SO_DAKOT\01LAKEAN.01

Missing:
1972-1978
1980, 1981
1996, 1997

Where is History of Lake Andes?

LAKE ANDES NATIONAL WILDLIFE REFUGE COMPLEX

2001 ANNUAL WATER MANAGEMENT PLAN
2000 WATER CONDITIONS AND USAGE

Submitted: Bruce J Schoonover Date: 2/15/01
Acting Refuge Manager

Approved: Ron Rauppe Date: 2/22/01
Refuge Supervisor

Reviewed: Chy C Willers Date: 3-1-01
Chief, Div. of Water Resources

United States Department of the Interior
FISH AND WILDLIFE SERVICE
LAKE ANDES NATIONAL WILDLIFE REFUGE COMPLEX
38672 291st Street
LAKE ANDES, SOUTH DAKOTA 57356-6838
605-487-7603

U.S. Department of the Interior 1849-1999

MEMORANDUM

To: Ron Shupe, Refuges Supervisor

From: Bruce Schoonover, Acting Refuge Manager

Subject: Water Plan

Find attached the 2000 Annual Water Management Plan and Water Conditions and Usage Report for Lake Andes Complex. The signature page is on top. Thanks.

Bruce

2001 ANNUAL WATER MANAGEMENT PLAN
AND
2000 WATER CONDITIONS AND USAGE

LAKE ANDES NATIONAL WILDLIFE REFUGE COMPLEX
LAKE ANDES, SD

WATER UNIT: Lake Andes

I. Introduction

Lake Andes is a 4730 acre meandered lake whose water level depends entirely upon annual runoff. Two dikes divide the lake into three units, the North, Center, and South. Stop log water control structures are located within each dike, however, the lack of a permanent water supply precludes any water level manipulations.

Drainage area size and surface acres for each unit of Lake Andes are shown below. Maximum and average depth figures were determined in 1962.

Unit	Drainage Area Acres	Surface Acres of Water	Water Capacity (Acre Feet)	Depth/full Max	Avg
South	20,000 24%	1,760	16,159	13.5	11.5
Center	11,000 14%	2,359	18,000	14.5	12.9
North	53,000 62%	611	3,015	10.5	9.1
TOTAL	84,000 100%	4,730	37,174	--	–

In 1922, Congress passed a bill establishing a high water elevation of 1437.25 feet msl for Lake Andes via the construction of an artificial outlet on the South Unit. This level was established following local complaints about flooding around the lake. The Fish and Wildlife Service received the right to flood the meandered lake bed of Lake Andes in an easement acquired in 1939 from the State of South Dakota.

II. Objectives

As long as water is present in Lake Andes, it is utilized by water dependent wildlife species year round. It serves primarily as a roost and stop over for migrating waterfowl. Fair brood habitat exists in the North Unit and poor brood habitat exists in the remaining portion of the lake. The objective for Lake Andes is to provide as much habitat as possible for nesting and migrating waterfowl under current weather conditions.

III. 2000 Water Conditions

Total precipitation for 2000 was 16.70 inches, 4.71 inches below normal.

2000 Lake Andes Water Levels - Feet MSL

Date	North Unit	Center Unit	South Unit
03/28	1436.5	1436.5	1436.5
08/01	1435.6	1435.6	1435.6
10/16	1433.8	1433.8	1433.8

IV. Ecological Effects of the Past Years Levels on Lake Andes

Between 1987 and 1992, Lake Andes was suffering from the lack of adequate rainfall and runoff. During this time, all three units came very close to becoming void of water. The low water conditions, however, stimulated an increase in aquatic vegetation, preparing the lake for excellent habitat once water again became available. In addition, limited rough fish control was achieved by fish die offs in both the summer of 1992 and winter of 1992-93. The remaining rough fish were primarily found in the South Unit. Unfortunately, by 1994 rough fish were found in excessive numbers throughout all areas of Lake Andes.

Heavy precipitation occurred in 1993 resulting in significant runoff events and significant increases in water elevations. Water flowed over both the North and Center Unit dikes. Unit levels during 1994 remained steady to slightly decreasing when compared to the 1993 levels. Slight decreases in the amount of visible aquatic plant life was also noticed in 1994. A deluge of water again occurred in 1995. Water flowed over both the North and Center Unit dikes. 1996 water levels remained at the high water mark. Emergent and submergent aquatic vegetation greatly decreased.

In 1997, runoff and precipitation began to raise the water level in excess of the highwater mark once again. To prevent water from overflowing the dikes, the stop logs were taken out of the South Unit structure to allow unrestricted flow. Water levels remained above the high water mark during the summer months, but did not top over the dikes. Water levels in 1998 and 1999, remained at the high water mark.

Rough fish populations continue to be at high levels and are negatively impacting all aquatic vegetation and water quality in all three units of Lake Andes. This condition limits the effectiveness of Lake Andes to provide quality habitat conditions for waterfowl.

The colonial nesting bird colony in Johnson's Bay (of Lake Andes) was active again in 1999. Primary nesters in the colony are black-crowned night herons, cattle egrets, great egrets, cormorants, and great-blue herons.

Below normal rainfall and runoff led to steadily dropping water levels in 2000. At the onset of spring, the lake was at .75' below the high water mark. By mid-October, the lake had dropped an additional 2.75'. The receding water created excellent mud flat habitat for shorebirds, particularly in the North Unit and the Johnson's Bay area of the Center Unit. Rough fish populations continue to be high, water quality is poor, and aquatic vegetation is virtually non-existent.

V. 2001 Water Management Objectives

Management objectives for 2001 are to restore water levels to the 1437.25 feet msl elevation by containing as much runoff as possible in Lake Andes.

WATER UNIT: Owens Bay

I. Introduction

The Owens Bay Unit is a 240 acre marsh unit separated by a dike from the South Unit of Lake Andes. A stop log water control structure is located in this dike to allow water releases into Lake Andes. This unit also includes three man-made ponds (Prairie Ponds) which are located along the northwest shore of Owens Bay.

220-3

Owens Bay, in addition to water from natural runoff, is maintained by a free flowing artesian well. The well, drilled in 1957, originally had a 1000 gpm flow and water right. Well shutdowns during the 1973 DVE outbreak resulted in casing destruction and a new casing had to be installed. The new casing reduced the well opening from 12 inches to 8 inches and dropped the flow to approximately 450 gpm.

In 1986, Ducks Unlimited funded the drilling of a new 12 inch artesian well and the old well was capped. The new well has a 800-1000 gpm flow. The well distribution box and pipeline supplying the Prairie Ponds were also replaced. The four water control structures on the Prairie Ponds were retrofitted with new screw gates in 1987.

Two of the screw gates were replaced in 1997 with stop log structures (in Prairie Ponds 2 and 3), and two additional stop log structures were placed for better water level manipulation. The two new structures allow flow from Prairie Ponds 2 and 3 directly to Lake Andes.

The artesian well and rainfall are the water resources used to fill the Prairie Ponds.

II. Objectives

Waterfowl production is the primary objective on Owens Bay. Secondary objectives include providing habitat for migrating waterfowl and other water dependent species such as marsh and water birds, shorebirds, gulls, terns, and resident wildlife. Structurally, approximately one half of the unit should be shallow water (less than 0.5m) in depth and contain a vegetation-open water interspersion rate of 50:50% to provide cover, invertebrate substrate, and access to invertebrates for pre-nesting female waterfowl and waterfowl broods. The remaining one half of the unit may be composed of open water with depths >0.5 m, but less than 2 m. This deep water zone should support submerged aquatic vegetation, predominately *Potamogeton pectinatus* and a lesser extent of *Chara spp.*, and be attractive to migratory waterfowl providing both invertebrate substrate and plant material as food resources.

Although the Prairie Ponds are each unique in their habitat contributions, the overall complex provides the same primary and secondary objectives as the Owens Bay Unit.

III. 2000 Water Conditions

The water level in Owens Bay had been lowered in 1997 by a partial draw down to: 1) stimulate germination of robust emergent vegetation (cattail and bullrush) to provide suitable cover; and 2) stimulate annual vegetation growth such as smartweed, millet, and nutsedge to increase the diversity of invertebrates by providing vegetative structure. The objectives were accomplished by the germination of a narrow band of cattail, some bulrush, and extensive areas of annual vegetation. The draw down water level was retained throughout the fall and winter which provided a limited carp winter kill.

As spring snow melt and precipitation began to raise the water level in the bay, 1998 water level manipulation began with the release of water into Lake Andes. A complete draw down was the 1998 objective. Unfortunately, water levels in the South Unit precluded the total de-watering of the area as did the siltation in the "outlet" channel. The 1998 partial draw down did, however, create a second band of exposed mud flat which dried sufficiently to provide substrate for plants such as nutsedge and goosefoot.

The estimated area of the exposed soils vs. open water in 1998 was at a 60% to 40% ratio. The remaining open water area was between 6-12" in depth.

Water levels during 1999 were kept at a moderate level. Runoff and rainfall were retained to the level that existing vegetation was flooded without killing the cattail that germinated during the 1998 growing season.

Owen's Bay was still in a draw-down status coming into the spring of 2000. The remaining open water was 6-12" deep. Boards were left out of the outlet structure until early May to allow for a 280 acre prescribed fire which included approximately the northern ½ of the Owen's Bay perimeter. The perimeter consisted mostly of cattail and was from 75-125 yards in width. The absence of boards in the outlet structure had no effect on the water level as no runoff occurred during this time. Subsequent

low rainfall and runoff amounts during the summer of 2000 resulted in the total de-watering of Owen's Bay. The unit was completely dry by August 1st and remained dry through the end of the year.

2000 Water Levels - Owens Bay

Date	Water Level
03/28	1437.9
08/01	1436.52
10/16	1436.52
Pool Bottom	1436.52
Full Pool Elevation	1442.12

All three Prairie Ponds were completely drawn down during the 1997 and 1998 growing season and re-flooded in the fall prior to migration.

Prairie Ponds 1 and 2 were maintained at a moderate level in 1999 and 2000 to provide brood habitat for waterfowl. The water level in Prairie Pond 3 was kept at a high level in both 1999 and 2000 in attempt to eliminate the woody vegetation invading the unit.

IV. Ecological Effects of the Past Years Levels on Owens Bay

Owens Bay water levels remained high during the wet years, 1993-96, and before water level manipulation was attempted. The heron and egret colony established in 1994 was heavily used by cattle egrets, great egrets, great-blue herons, and black-crowned night herons until the trees became decadent, losing most of their limbs and, thus, becoming unattractive in 1996. This colony was made possible by cottonwood trees becoming established at the perimeter of the bay during the previous drought years and subsequent re-flooding.

The partial draw downs on Owens Bay in 1997 and 1998 have resulted in increased brood habitat for waterfowl and exposed mud flat for migrating and nesting shorebirds. Two distinct bands of vegetative growth have greatly increased the diversity of invertebrates. Conditions prior to draw down were such that the majority of the unit was open water with a limited cattail shoreline edge. Extensive submerged aquatic vegetation, primarily pondweeds, existed. The draw down in 1998 also contributed to a limited carp winter kill. Because of the high water events in 1996 and 1997, carp had entered the unit, posing a concern for water quality and aquatic vegetation.

1999 water levels remained at a moderate level, inundating the existing vegetation without harming the newly germinated cattail band. The increase of brood habitat was greatly enhanced by this management technique.

In 2000, water levels were low (6-12" depth) in spring and early summer and Owen's Bay was completely de-watered by August 1, providing both a complete fish kill and complete draw-down. This de-watering event should contribute to excellent habitat conditions on Owen's Bay in the upcoming years.

All three Prairie Ponds were drawn down completely during the 1997 and 1998 growing season to reestablish an interspersion of open water and robust emergent vegetation and to allow construction/rehabilitation work on the water control structures. The draining and drying of the soil released nutrients and made them available for a diversity of plants to germinate and grow. During the interim fall/winter periods, the units were re-flooded to provide migratory waterbird habitat.

Prairie Ponds 1 and 2 provided excellent brood habitat in 1999 and 2000. Cattail fringed the outer edges of both ponds. High water levels in Prairie Pond 3 eliminated the woody vegetation growth in the unit which was replaced by cattail. Interspersion in this unit is approximately 50:50 (cattail/open water).

The ponds as well as the Owens Bay Unit are utilized by all common waterfowl and shorebird species. A sighting of ten avocet pairs was recorded in 1997 using the newly exposed shoreline on Owens Bay. Many of the birds were displaying breeding/brood rearing behavior, however, no young birds or nests were found to confirm this activity.

V. 2001 Water Management Objectives

Run off and rainfall will be captured in the Owens Bay Unit at a level that will inundate existing vegetation ($\leq$ 1.0 m), without sacrificing brood habitat. Outer fringes will have less water while the center and deeper portions will retain more. Mud flat sites will still be provided in areas within the bay.

Prairie Pond 1 will be maintained at a moderate level to serve as brood habitat for waterfowl. Prairie Pond 2 will be partially drawn-down in the spring then re-flooded in the fall to provide a fall food source for migrating waterfowl and spring brood habitat in 2002. Water levels in Pond 3 will be kept higher to insure woody vegetation that still exists is over topped and retain the dispersion of cattail in the unit. The influx of muskrats will keep the 50:50 ratio in this unit.

WATER UNIT: Broken Arrow Waterfowl Production Area

I. Introduction

5077-3

The Broken Arrow WPA is a 2650 acre tract in Douglas and Charles Mix Counties. Two drainage systems existed on the property when purchased. The Mud Lake Drain has an upstream watershed of 25,600 acres while the second system, the Joubert Drain, has a 12,320 acre watershed. Five ditch plugs or low head dams with concrete stop log control structures were installed in 1979 along the drainage ditches, two on the Mud Lake Drain and the remaining three on the Joubert Drain. Dam #6

was constructed below Dam #2 on the Mud Lake Drain in 1984. Dam #7 on the Joubert Drain was constructed during the fall of 1986 in cooperation with Ducks Unlimited who funded the project design and construction. Then in 1991, the five water control structures were retrofitted. Stop log structures replaced the nonfunctional stop log lift-gate structures.

A water rights permit for the storage of 131.2 acre feet of water was granted by the South Dakota Department of Water and Natural Resources. The impoundment at capacity covers 56.4 surface acres. The development increased the quantity of pair habitat by creating 5.9 miles of shoreline. The maximum depth is 6.5 feet. Design specifications for the seven dams are as follows:

Embankment Volume YD^3	High Water Contour	Surface Acres	Acre-feet Impounded
Dam #1 - 76	Unk	6.2	5.7
Dam #2 - 755	Unk	27.9	82.6
Dam #3 - 2761	Unk	43.6	163.0
Dam #4 - 586	Unk	34.7	88.3
Dam #5 - 137	Unk	6.3	5.2
Dam #6 - 900	Unk	30.0	Not determined
Dam #7 - 5470	1526.0	56.4	131.2
	TOTAL	205.1	476.0

The capability to manipulate water levels is very limited on the Broken Arrow WPA. Impoundments can be drawn down as objectives dictate. However, re-flooding depends primarily on spring runoff and the amount of water stored in the either the Mud Lake system or the Joubert system. Minimal capability to flood when desired is possible.

In 1999, the Joubert system was fully drawn down to allow for flood damages to be repaired on dike #3. In addition, a new stop log structure was installed, in dike #3, replacing a non-functional water control structure.

II. Objectives

Habitat for waterfowl production is the primary management objective for the Broken Arrow WPA. The habitat provided also benefits marsh and water birds, shorebirds, gulls, terns, and raptors. Secondary benefits are provided to resident wildlife. A short duration grazing system is used for upland management.

III. 2000 Water Conditions

The winter of 1998-99 was mild with very minimal snowpack in the Broken Arrow drainage. Total precipitation is not monitored on site, however, it is similar to that of Lake Andes NWR which was near normal.

In 1999, the mud lake system was maintained at approximately half pool to encourage the growth of aquatic vegetation. The Joubert system was completely drawn down to allow for repair work on dike #3.

Low precipitation and runoff kept the Joubert system de-watered for all of 2000. The Mud Lake system maintained a fair amount of water, but by years end was retaining less than half its capacity.

IV. Ecological Effects of the Past Years Water Levels on the Broken Arrow WPA

All impoundments within the Broken Arrow WPA experienced excellent growth in the pool bottoms by smartweed, nutsedge, *Potamogeton spp.*, some bulrush, and other sedges and rushes during the drought years. During the 1993 high water levels, water was retained in all pools except Dam #4. This structure was washed out in 1993 and not repaired until 1994. The pool was considered in a drawn down condition prior to and after the repair of this structure. Dramatic aquatic plant growth resulted from this draw down event and shorebird use was high. Subsequent reflooding of this pool did not occur until 1995. All other pools remained in good condition through 1995. However, the structures were not designed to handle the amount of water received in 1995, resulting in emergency spillways operating at maximum levels.

Normal springtime precipitation in 1996-98 allowed the desired recharge of wetlands within the two storage systems. 1996 water levels were kept below the 1995 levels with the largest impoundment in partial draw down condition. Water levels were kept at full pool in 1997.

Both the Mud Lake and Joubert Drainage systems were drawn down to half pool in 1998. Vegetative response was excellent. The Mud Lake system was left at half pool in 1999 while the Joubert system was fully drawn down to allow for flood damages to be repaired to dike #3 as well as the installation of a new stop log structure.

Although, the water control structures allow water manipulation only moderate control can be obtained which proves to be very frustrating at times. Recharge of water is totally dependent on rainfall and runoff.

Limited rough fish control was achieved by the lowering of the pools during the summers of 1997, 1998, and 1999.

Coming into 2000, both the Mud Lake and Joubert systems were poised for re-flooding. Mother nature did not assist with the moist-soil management efforts, though, and both systems remained at or below 1999 water levels.

V. 2001 Water Management Objectives

Water management objectives for 2001 are to reach water levels of half pool in both systems and maintain levels there to promote and maintain the fringed band of annual vegetation.

WATER UNIT: Karl E. Mundt National Wildlife Refuge

The Karl E. Mundt NWR borders the Missouri River in Gregory County. The refuge was established in 1974 to protect habitat important to wintering bald eagles. The only water on the unit itself is located within four small (less than 1 acre) stock ponds that are used in conjunction with the grazing program, and a one half acre pond fed by a free flowing artesian well. There is presently no active management of water on the Karl E. Mundt Refuge.

WATER UNIT: Sherman Waterfowl Production Area
SD Water Permit No. 5251-3

This water permit is for sufficient runoff water annually to fill the Sherman WPA to an elevation of 1591.7 feet msl. The Sherman WPA is located in a portion of the W½ Section 3; E½NE¼ Section 9; NW¼NW¼ Section 10; all in T. 98 N., R. 66 W., Charles Mix County. The permit establishes first priority to 271 feet of an undivided interest in a total of 323 acre feet of water stored in a natural basin on both the Sherman WPA and private land at elevation 1591.7 feet msl. The water appropriated shall be used for the purpose of providing fish and wildlife habitat.

WATER UNIT: Varilek Waterfowl Production Area
SD Water Permit No. 5250-3

This water permit is for sufficient runoff water annually to fill the Varilek WPA to an elevation of 1614.0 feet msl. The Varilek WPA is located in the E½ Section 11, T. 98 N., R. 66 W., Charles Mix County. The permit establishes first priority to 139 acre feet of an undivided interest in a total of 190 acre feet of water stored in a natural basin both on the Varilek WPA and private land at elevation 1614 feet msl. The water appropriated is used for the purpose of providing fish and wildlife habitat.

WATER UNIT: Roth Waterfowl Production Area
SD Water Permit No. 6013-3

This water permit authorizes storage of 323 acre feet of water in the Roth WPA and sufficient water annually to maintain the water level to an elevation of 1398.5 feet msl. Five hundred and thirty-five acre feet of water annually can be appropriated using an existing plug in a man-made ditch for a wetland restoration project. The structure impounds 323 acre feet of water with an additional 212 acre feet to be appropriated to offset evaporation. The ditch plug is located in the NE1/4SE1/4, Section 10 with water impounded in the E1/2SW1/4, SE1/4, Section 10; SW 1/4SW1/4, Section 11; NW1/4NW1/4, Section 14; and NE 1/4NE1/4, Section 15; all in T98N-R60W. The water appropriated is used for the purpose of supplying water to provide habitat for fish and wildlife propagation and domestic use.